HFE1600
RELIABILITY DATA

DWG: IA688-79-01		
APPD	CHK	DWG
17-7-2013	Asher Sh. 16-July-13	16.07.2013

TDK-Lambda

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The above data is typical value. As all units have nearly the same characteristics,the data to be considered as ability value.

1. M.T.B.F

1.1 Method of calculation according to Telcordia (Bellcore):

Limited Stress - Method I, Case 3, Ambient temperature-25°C, GB (Ground,Benign)
Individual failure rates is given to each part and M.T.B.F is calculated by
the count of each part

$$\lambda = \sum_{i=1}^{n} \lambda_i \qquad MTBF = \frac{1}{\lambda}$$

where:

λ_i failure rate of I's item

n number of item

1.2 M.T.B.F Values according to Telcordia (Bellcore)

<u>M.T.B.F = 210,143.7 (HOURS)</u>

1.3 Method of calculation according to JEITA (RCR-9102)

based on part count reliability projection of MIL-HDBK-217F, GF (Ground,Fixed)
Individual failure rates is given to each part and M.T.B.F is
calculated by the count of each part.

$$\mathrm{MTBF} = \frac{1}{\lambda_{equip}} = \frac{1}{\sum_{i=1}^{n} N_i (\lambda_G \pi_Q) i} \times 10^6 (\mathrm{Hours})$$

Where:

λ_{equip} = Total Equipment Failure Rate (Failures / 10^6 Hours)
λ_G = Generic Failure Rate For The ith Generic Part (Failure / 10^6 Hours)
N_i = Quantity of ith Generic Part
n = Number of Different Generic Part Categories
π_Q = Generic Quality factor for the Generic Part ($\pi_Q = 1$)

1.4 M.T.B.F Value according to JEI TA (RCR-9102)

M.T.B.F = 35,688 (HOURS)

2.COMPONENT DERATING

Calculation method

a) Condition

Output:	Vout - 100%, Iout - 100%
Ambient temperature:	50°C
Mounting Method:	Standard (horizontal) mounting

b) Semiconductors

Compared with maximum junction temperature and actual one which is calculated on case temperature, power dissipation and thermal impedance.

c) Semiconductors, Resistors, Capacitors, etc.

Ambient temperature, operating condition, power dissipation and so on are within derating criteria.

d) Calculation method of thermal impedance

$$\theta\, j\text{-}c = \frac{Tj(max)-Tc}{Pc(max)} \qquad \theta\, j\text{-}a = \frac{Tj(max)-Ta}{Pc(max)} \qquad \theta\, j\text{-}l \; \frac{Tj(max)-Tl}{Pc(max)}$$

Tc:	Case Temperature at Start Point of Derating; 25°C in General
Ta:	Ambient Temperature at Start Point of Derating; 25°C in General
Pc(max):	Maximum Power Dissipation
Tj(max):	Maximum Junction temperature
θ j-c:	Thermal Impedance between Junction and Case
θ j-a:	Thermal Impedance between Junction and Air
θ j-l:	Thermal Impedance between Junction and Lead

(2) Component derating list

Location №	Vin=230VAC			Load = 100%			Ta=50°C		
A107	Tjmax=	150	°C	θj-c =	3.0	°C/W			
MIP0224SY	Pd =	3.5	W	ΔTc =	38.0	°C	Tc =	88.0	°C
MATSUSHITA	Tj = Tc + (θ j-c x Pd) =				98.5	°C	D.F. =	65.7	%
A104	Tjmax=	150	°C	θj-c =	42.0	°C/W			
MC33063AD	Pd =	0.9	W	ΔTc =	38.6	°C	Tc =	88.6	°C
TI	Tj = Tc + (θ j-c x Pd) =				126.4	°C	D.F. =	84.3	%
A401	Tjmax=	125	°C	θj-a =	140.0	°C/W			
UCC28061D	Pd =	0.046	W	ΔTa =	14.6	°C	Ta =	64.6	°C
TI	Tj = Ta + (θ j-a x Pd) =				71.0	°C	D.F. =	56.8	%
A403	Tjmax=	150	°C	θj-a =	250.0	°C/W			
FA13843NHLTP-EL-E	Pd =	0.04	W	ΔTa =	14.0	°C	Ta =	64.0	°C
FUJI	Tj = Ta + (θ j-a x Pd) =				74.0	°C	D.F. =	49.3	%
A601	Tjmax=	150	°C	θj-a =	38.0	°C/W			
LM5033MM NOPB	Pd =	0.4	W	ΔTa =	14.0	°C	Ta =	64.0	°C
NATIONAL SEMI	Tj = Ta + (θ j-a x Pd) =				79.2	°C	D.F. =	52.8	%
A602	Tjmax=	125	°C	θj-a =	285.0	°C/W			
TPS2819DBVR	Pd =	0.023	W	ΔTa =	14.0	°C	Ta =	64.0	°C
TI	Tj = Ta + (θ j-a x Pd) =				70.6	°C	D.F. =	56.5	%
A603	Tjmax=	125	°C	θj-a =	285.0	°C/W			
TPS2819DBVR	Pd =	0.023	W	ΔTa =	14.0	°C	Ta =	64.0	°C
TI	Tj = Ta + (θ j-a x Pd) =				70.6	°C	D.F. =	56.5	%
A651	Tjmax=	150	°C	θj-a =	38.0	°C/W			
LM5033MM NOPB	Pd =	0.4	W	ΔTa =	15.0	°C	Ta =	65.0	°C
NATIONAL SEMI	Tj = Ta + (θ j-a x Pd) =				80.2	°C	D.F. =	53.5	%
A652	Tjmax=	150	°C	θj-a =	200.0	°C/W			
LM5102MM	Pd =	0.02	W	ΔTa =	16.0	°C	Ta =	66.0	°C
NATIONAL SEMI	Tj = Ta + (θ j-a x Pd) =				70.0	°C	D.F. =	46.7	%
A653	Tjmax=	150	°C	θj-a =	200.0	°C/W			
LM5102MM	Pd =	0.02	W	ΔTa =	15.0	°C	Ta =	65.0	°C
NATIONAL SEMI	Tj = Ta + (θ j-a x Pd) =				69.0	°C	D.F. =	46.0	%
A701	Tjmax=	125	°C	θj-a =	200.0	°C/W			
LTC43571MS8#TRPBF	Pd =	0.01	W	ΔTa =	42.9	°C	Ta =	92.9	°C
LINEAR	Tj = Ta + (θ j-a x Pd) =				94.9	°C	D.F. =	75.9	%
A801	Tjmax=	150	°C	θj-c =	42.0	°C/W			
MC33063AD	Pd =	0.5	W	ΔTc =	51.0	°C	Tc =	101.0	°C
TI	Tj = Tc + (θ j-c x Pd) =				122.0	°C	D.F. =	81.3	%

Location №	Vin=230VAC				Load = 100%			Ta=50°C	
D101	Tjmax=	150	°C	θ_{j-c} =	0.6	°C/W			
GBJ2506	Pd =	24	W	ΔTc =	47.6	°C	Tc =	97.6	°C
DIODES	Tj = Tc + (θ j-c x Pd) =				112.0	°C	D.F. =	74.7	%
D107	Tjmax=	150	°C	θ_{j-c} =	3.5	°C/W			
YG912S6RR	Pd =	4	W	ΔTc =	32.8	°C	Tc =	82.8	°C
FUJI	Tj = Tc + (θ j-c x Pd) =				96.8	°C	D.F. =	64.5	%
D108	Tjmax=	150	°C	θ_{j-c} =	3.5	°C/W			
YG912S6RR	Pd =	4	W	ΔTc =	39.9	°C	Tc =	89.9	°C
FUJI	Tj = Tc + (θ j-c x Pd) =				103.9	°C	D.F. =	69.3	%
D109	Tjmax=	150	°C	θ_{j-c} =	3.5	°C/W			
YG902C3R	Pd =	3.5	W	ΔTc =	48.2	°C	Tc =	98.2	°C
FUJI	Tj = Tc + (θ j-c x Pd) =				110.5	°C	D.F. =	73.6	%
D110	Tjmax=	150	°C	θ_{j-c} =	3.5	°C/W			
YG902C3R	Pd =	3.5	W	ΔTc =	40.5	°C	Tc =	90.5	°C
FUJI	Tj = Tc + (θ j-c x Pd) =				102.8	°C	D.F. =	68.5	%
Q101	Tjmax=	150	°C	θ_{j-c} =	0.5	°C/W			
IPW60R099CP	Pd =	4	W	ΔTc =	27.3	°C	Tc =	77.3	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				79.3	°C	D.F. =	52.9	%
Q102	Tjmax=	150	°C	θ_{j-c} =	0.5	°C/W			
IPW60R099CP	Pd =	4	W	ΔTc =	26.5	°C	Tc =	76.5	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				78.5	°C	D.F. =	52.3	%
Q103	Tjmax=	150	°C	θ_{j-c} =	0.5	°C/W			
IPP60R099CP	Pd =	10	W	ΔTc =	53.2	°C	Tc =	103.2	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				108.2	°C	D.F. =	72.1	%
Q104	Tjmax=	150	°C	θ_{j-c} =	0.5	°C/W			
IPP60R099CP	Pd =	10.0	W	ΔTc =	58.0	°C	Tc =	108.0	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				113.0	°C	D.F. =	75.3	%
Q113	Tjmax=	150	°C	θ_{j-c} =	0.4	°C/W			
IPW60R075CP	Pd =	12.0	W	ΔTc =	42.6	°C	Tc =	92.6	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				97.4	°C	D.F. =	64.9	%
Q114	Tjmax=	150	°C	θ_{j-c} =	0.4	°C/W			
IPW60R075CP	Pd =	12.0	W	ΔTc =	36.6	°C	Tc =	86.6	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				91.4	°C	D.F. =	60.9	%

12V

Location №	Vin=230VAC			Load = 100%				Ta=50°C	
Q501	Tjmax=	150	°C	θ_{j-c} =	0.9	°C/W			
BSC017N04NS G	Pd =	0.47	W	ΔT_c =	32.2	°C	Tc =	82.2	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				82.6	°C	D.F. =	55.1	%
Q502	Tjmax=	150	°C	θ_{j-c} =	0.9	°C/W			
BSC017N04NS G	Pd =	0.47	W	ΔT_c =	32.2	°C	Tc =	82.2	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				82.6	°C	D.F. =	55.1	%
Q503	Tjmax=	150	°C	θ_{j-c} =	0.9	°C/W			
BSC017N04NS G	Pd =	0.47	W	ΔT_c =	33.1	°C	Tc =	83.1	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				83.5	°C	D.F. =	55.7	%
Q504	Tjmax=	150	°C	θ_{j-c} =	0.9	°C/W			
BSC017N04NS G	Pd =	0.47	W	ΔT_c =	36.1	°C	Tc =	86.1	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				86.5	°C	D.F. =	57.7	%
Q507	Tjmax=	150	°C	θ_{j-c} =	0.9	°C/W			
BSC017N04NS G	Pd =	0.47	W	ΔT_c =	41.7	°C	Tc =	91.7	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				92.1	°C	D.F. =	61.4	%
Q508	Tjmax=	150	°C	θ_{j-c} =	0.9	°C/W			
BSC017N04NS G	Pd =	0.47	W	ΔT_c =	36.3	°C	Tc =	86.3	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				86.7	°C	D.F. =	57.8	%
Q509	Tjmax=	150	°C	θ_{j-c} =	0.9	°C/W			
BSC017N04NS G	Pd =	0.47	W	ΔT_c =	32.2	°C	Tc =	82.2	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				82.6	°C	D.F. =	55.1	%
Q510	Tjmax=	150	°C	θ_{j-c} =	0.9	°C/W			
BSC017N04NS G	Pd =	0.47	W	ΔT_c =	32.2	°C	Tc =	82.2	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				82.6	°C	D.F. =	55.1	%

24V

Location №	Vin=230VAC			Load = 100%			Ta=50°C		
Q501	Tjmax=	150	°C	θj-c =	0.8	°C/W			
BSC079N10NS G	Pd =	0.69	W	ΔTc =	48.6	°C	Tc =	98.6	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				99.2	°C	D.F. =	66.1	%
Q502	Tjmax=	150	°C	θj-c =	0.8	°C/W			
BSC079N10NS G	Pd =	0.69	W	ΔTc =	48.6	°C	Tc =	98.6	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				99.2	°C	D.F. =	66.1	%
Q503	Tjmax=	150	°C	θj-c =	0.8	°C/W			
BSC079N10NS G	Pd =	0.69	W	ΔTc =	47.0	°C	Tc =	97.0	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				97.6	°C	D.F. =	65.1	%
Q504	Tjmax=	150	°C	θj-c =	0.8	°C/W			
BSC079N10NS G	Pd =	0.69	W	ΔTc =	49.1	°C	Tc =	99.1	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				99.7	°C	D.F. =	66.5	%
Q507	Tjmax=	150	°C	θj-c =	0.8	°C/W			
BSC079N10NS G	Pd =	0.69	W	ΔTc =	51.1	°C	Tc =	101.1	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				101.7	°C	D.F. =	67.8	%
Q508	Tjmax=	150	°C	θj-c =	0.8	°C/W			
BSC079N10NS G	Pd =	0.69	W	ΔTc =	48.7	°C	Tc =	98.7	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				99.3	°C	D.F. =	66.2	%
Q509	Tjmax=	150	°C	θj-c =	0.8	°C/W			
BSC079N10NS G	Pd =	0.69	W	ΔTc =	47.7	°C	Tc =	97.7	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				98.3	°C	D.F. =	65.5	%
Q510	Tjmax=	150	°C	θj-c =	0.8	°C/W			
BSC079N10NS G	Pd =	0.69	W	ΔTc =	47.7	°C	Tc =	97.7	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				98.3	°C	D.F. =	65.5	%

32V

Location №	Vin=230VAC			Load = 100%			Ta=50°C		
Q551	Tjmax=	150	°C	$\theta_{j\text{-}c}$ =	1.1	°C/W			
BSC057N08NS3 G	Pd =	2.2	W	ΔT_c =	46.3	°C	Tc =	96.3	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				98.7	°C	D.F. =	65.8	%
Q552	Tjmax=	150	°C	$\theta_{j\text{-}c}$ =	1.1	°C/W			
BSC057N08NS3 G	Pd =	2.2	W	ΔT_c =	48.8	°C	Tc =	98.8	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				101.2	°C	D.F. =	67.5	%
Q553	Tjmax=	150	°C	$\theta_{j\text{-}c}$ =	1.1	°C/W			
BSC057N08NS3 G	Pd =	2.2	W	ΔT_c =	49.1	°C	Tc =	99.1	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				101.5	°C	D.F. =	67.7	%
Q554	Tjmax=	150	°C	$\theta_{j\text{-}c}$ =	1.1	°C/W			
BSC057N08NS3 G	Pd =	2.2	W	ΔT_c =	47.3	°C	Tc =	97.3	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				99.7	°C	D.F. =	66.5	%
Q555	Tjmax=	150	°C	$\theta_{j\text{-}c}$ =	1.1	°C/W			
BSC057N08NS3 G	Pd =	2.2	W	ΔT_c =	47.8	°C	Tc =	97.8	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				100.2	°C	D.F. =	66.8	%
Q556	Tjmax=	150	°C	$\theta_{j\text{-}c}$ =	1.1	°C/W			
BSC057N08NS3 G	Pd =	2.2	W	ΔT_c =	42.1	°C	Tc =	92.1	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				94.5	°C	D.F. =	63.0	%
Q557	Tjmax=	150	°C	$\theta_{j\text{-}c}$ =	1.1	°C/W			
BSC057N08NS3 G	Pd =	2.2	W	ΔT_c =	39.2	°C	Tc =	89.2	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				91.6	°C	D.F. =	61.1	%
Q558	Tjmax=	150	°C	$\theta_{j\text{-}c}$ =	1.1	°C/W			
BSC057N08NS3 G	Pd =	2.2	W	ΔT_c =	38.6	°C	Tc =	88.6	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				91.0	°C	D.F. =	60.7	%

48V

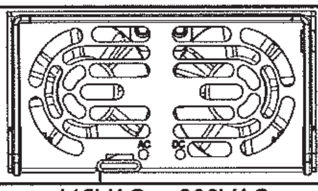
Location №	Vin=230VAC			Load = 100%				Ta=50°C	
Q551	Tjmax=	150	°C	θ_{j-c} =	0.8	°C/W			
BSC079N10NS G	Pd =	0.65	W	ΔTc =	35.6	°C	Tc =	85.6	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				86.1	°C	D.F. =	57.4	%
Q552	Tjmax=	150	°C	θ_{j-c} =	0.8	°C/W			
BSC079N10NS G	Pd =	0.65	W	ΔTc =	37.1	°C	Tc =	87.1	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				87.6	°C	D.F. =	58.4	%
Q553	Tjmax=	150	°C	θ_{j-c} =	0.8	°C/W			
BSC079N10NS G	Pd =	0.65	W	ΔTc =	36.1	°C	Tc =	86.1	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				86.6	°C	D.F. =	57.7	%
Q554	Tjmax=	150	°C	θ_{j-c} =	0.8	°C/W			
BSC079N10NS G	Pd =	0.65	W	ΔTc =	36.3	°C	Tc =	86.3	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				86.8	°C	D.F. =	57.9	%
Q555	Tjmax=	150	°C	θ_{j-c} =	0.8	°C/W			
BSC079N10NS G	Pd =	0.65	W	ΔTc =	35.7	°C	Tc =	85.7	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				86.2	°C	D.F. =	57.5	%
Q556	Tjmax=	150	°C	θ_{j-c} =	0.8	°C/W			
BSC079N10NS G	Pd =	0.65	W	ΔTc =	35.7	°C	Tc =	85.7	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				86.2	°C	D.F. =	57.5	%
Q557	Tjmax=	150	°C	θ_{j-c} =	0.8	°C/W			
BSC079N10NS G	Pd =	0.65	W	ΔTc =	32.0	°C	Tc =	82.0	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				82.5	°C	D.F. =	55.0	%
Q558	Tjmax=	150	°C	θ_{j-c} =	0.8	°C/W			
BSC079N10NS G	Pd =	0.65	W	ΔTc =	32.0	°C	Tc =	82.0	°C
INFINEON	Tj = Tc + (θ j-c x Pd) =				82.5	°C	D.F. =	55.0	%

3.MAIN COMPONENTS TEMPERATURE RISE ΔT LIST

12V

		ΔT Temperature Rise (°C)	
Location No.	Parts Name	115Vac	230Vac
A107	TOP SWITCH	39.0	39.6
A801	AUX REGULATOR	46.5	54.5
C101	"X" CAPACITOR	34.7	31.2
C110	ELEC. CAP.	11.4	11.7
C162	ELEC. CAP.	26.7	34.3
C180	ELEC. CAP.	21.4	26.2
D101	BRIDGE	56.1	47.6
D108	PF DIODE	35.5	39.9
D110	BUCK CLMP.DIODE	42.7	35.0
L102	EMI CHOKE	40.7	31.1
L104	PF CHOKE	65.3	61.1
L105	BUCK CHOKE	31.6	36.0
Q101	PF MOSFET	49.3	24.6
Q103	BUCK MOSFET	54.7	49.7
Q113	DC-DC MOSFET	28.1	37.1
Q507	RECTIFIER	32.5	41.7
Q705	ORING	37.6	52.6
T101	BIAS X'MER	45.8	46.8
T102	DRIVER X'MER	22.7	22.7
T104	DC-DC X'MER	44.2	61.1

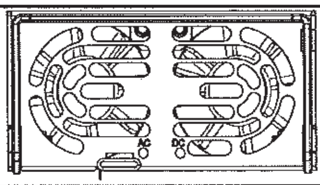
Conditions:

Standard Mounting	
Input Voltage	115VAC 230VAC
Output Voltage	12V 12V
Output Current	100A 133A
Ambient Temperature	50°C

24V

		ΔT Temperature Rise (°C)	
Location No.	Parts Name	115Vac	230Vac
A107	TOP SWITCH	35.1	36.2
A801	AUX REGULATOR	50.3	54.8
C101	"X" CAPACITOR	32.9	27.6
C110	ELEC. CAP.	7.7	8.1
C162	ELEC. CAP.	23.9	30.2
C180	ELEC. CAP.	16.5	21.3
D101	BRIDGE	54.7	44.1
D108	PF DIODE	34.4	39.1
D110	BUCK CLMP.DIODE	40.4	34.2
L102	EMI CHOKE	41.6	28.6
L104	PF CHOKE	59.0	62.8
L105	BUCK CHOKE	30.3	37.2
Q101	PF MOSFET	44.3	25.0
Q103	BUCK MOSFET	53.8	53.2
Q113	DC-DC MOSFET	31.1	42.6
Q507	RECTIFIER	32.2	44.4
Q705	ORING	28.5	37.2
T101	BIAS X'MER	49.0	50.7
T102	DRIVER X'MER	21.2	22.4
T104	DC-DC X'MER	57.1	72.8

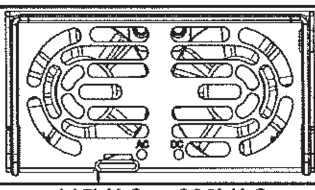
Conditions:

Standard Mounting		
Input Voltage	115VAC	230VAC
Output Voltage	24V	24V
Output Current	50A	67A
Ambient Temperature	50°C	

32V

		ΔT Temperature Rise (°C)	
Location No.	Parts Name	115Vac	230Vac
A107	TOP SWITCH	28.2	28.2
A801	AUX REGULATOR	47.7	49.9
C101	"X" CAPACITOR	33.2	30.1
C110	ELEC. CAP.	10.8	10.9
C162	ELEC. CAP.	21.6	28.1
C180	ELEC. CAP.	19.3	34.8
D101	BRIDGE	55.3	40.9
D108	PF DIODE	29.8	30.5
D110	BUCK CLMP.DIODE	37.4	35.2
L102	EMI CHOKE	37.1	26.0
L104	PF CHOKE	69.8	57.3
L105	BUCK CHOKE	29.8	36.6
Q101	PF MOSFET	30.6	24.9
Q103	BUCK MOSFET	49.8	49.6
Q113	DC-DC MOSFET	25.0	38.5
Q552	RECTIFIER	33.7	48.8
Q705	ORING	33.0	46.3
T101	BIAS X'MER	45.7	46.9
T102	DRIVER X'MER	24.6	25.1
T104	DC-DC X'MER	62.0	85.0

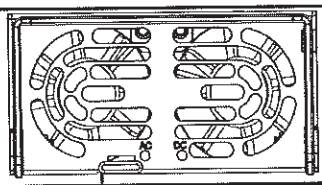
Conditions:

Standard Mounting	
Input Voltage	115VAC 230VAC
Output Voltage	48V 48V
Output Current	25A 33A
Ambient Temperature	50°C

48V

Location No.	Parts Name	ΔT Temperature Rise (°C) 115Vac	230Vac
A107	TOP SWITCH	32.0	32.0
A801	AUX REGULATOR	36.5	39.3
C101	"X" CAPACITOR	34.5	31.0
C110	ELEC. CAP.	11.1	11.3
C162	ELEC. CAP.	23.7	28.3
C180	ELEC. CAP.	21.1	25.5
D101	BRIDGE	51.0	40.7
D108	PF DIODE	29.3	32.1
D110	BUCK CLMP.DIODE	48.2	40.5
L102	EMI CHOKE	45.0	32.9
L104	PF CHOKE	73.9	60.4
L105	BUCK CHOKE	30.6	35.6
Q101	PF MOSFET	48.8	27.3
Q103	BUCK MOSFET	53.0	48.5
Q113	DC-DC MOSFET	28.6	42.6
Q552	RECTIFIER	28.3	37.1
Q705	ORING	29.4	36.5
T101	BIAS X'MER	46.1	47.0
T102	DRIVER X'MER	25.8	26.1
T104	DC-DC X'MER	59.7	70.7

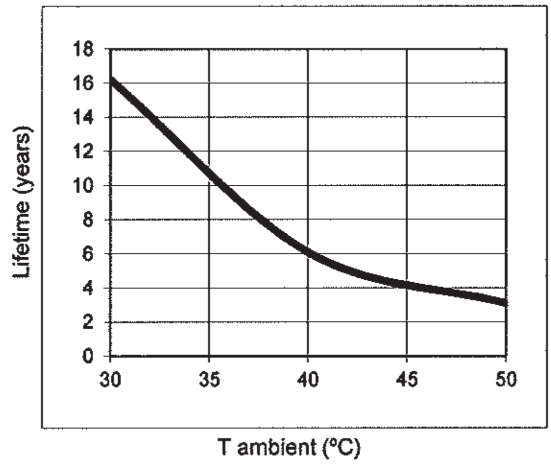
Conditions:

Standard Mounting		
Input Voltage	115VAC	230VAC
Output Voltage	48V	48V
Output Current	25A	33A
Ambient Temperature	50°C	

4.ELECTROLYTIC CAPACITORS LIFE TIME ESTIMATION

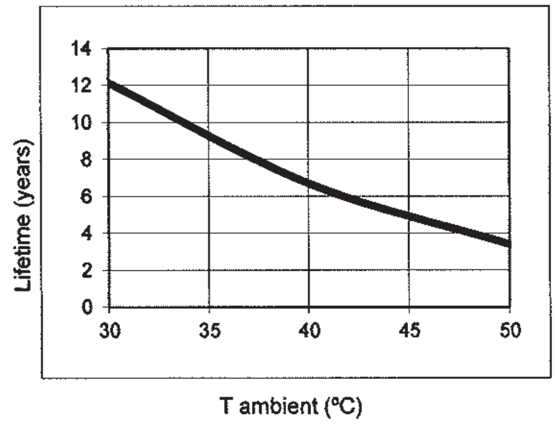
Vin=115Vac

MODEL	COMPUTED LIFE (year) at Tambient		
	30°C	40°C	50°C
HFE-1600	16.21	6.1	3.1



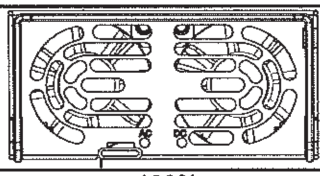
Vin=230Vac

MODEL	COMPUTED LIFE (year) at Tambient		
	30°C	40°C	50°C
HFE-1600	12.13	6.7	3.4



FORMULA: $$L = L_0 \times 2^{\frac{105 - T_C}{10}}$$ (years)

L: Elec.capacitor computed life (24 hours per day,365 days operation)
Lo: Guaranteed life for Elec.capacitor
Tc: Case temperature of Elec.capacitor

Standard Mounting	
Output Voltage	100%
Output Current	100%

5. ABNORMAL TEST

HFE1600

Vout=48V
Iout=33A
(Da:Damaged)

Model:48V
Input:230VAC

Ta:25°C, 70% RH

№	Location №	Test Point	Short	Open	1 Fire	2 Smoke	3 Burst	4 Smell	5 Red Hot	6 Damaged	7 Fuse opened	8 OVP	9 OCP	10 No Output	11 No Change	12 Others	Note
1	D101	AC-DC	O								O			O			F101
		AC-AC	O								O			O			F101
		AC		O											O		
		DC		O											O		
2	D107		O							O	O			O			F101, Q101, PFC/BUCK Control circuit
				O						O	O			O			F101, Q101
3	D108		O							O	O			O			F101, Q102, PFC/BUCK Control circuit
				O						O	O			O			F101, Q102
4	D109		O							O				O			R103, Q103, Q104, D110
				O						O	O			O			F101, Q103, Q104,
5	D110		O							O				O			R103, Q103, Q104, D109
				O						O	O			O			F101, Q103, Q104,
6	Q101	G-S	O							O						O	Vo decrease to 35V Da: R408
		D-S	O								O			O			F101
		D-G	O							O	O			O			F101, Q101, R408, R411, R412, Q402, ZD401, A401
		S		O						O				O			Q101, R408, R411, R412, Q402, ZD401, A401
		G		O						O	O			O			F101, Q101
		D		O												O	Vo decrease to 35V
7	Q102	G-S	O							O						O	Vo decrease to 35V Da: R407
		D-S	O								O			O			F101
		D-G	O							O	O			O			F101, Q102, R407, R409, R410, Q401, ZD402, A401
		S		O						O				O			Q102, R407, R409, R410, Q401, ZD402, A401
		G		O						O	O			O			F101, Q102
		D		O												O	Vo decrease to 30V
8	Q103	G-S	O											O		O	Pin=22W
		D-S	O									O		O			
		D-G	O							O				O			ZD101, Q106, R444, R445, D404, A403
		S		O						O				O			ZD101, Q106, R444, R445, D404, A403
		G		O						O				O			Da: Q103
		D		O												O	Q104 temp. rise 52°C --> 72°C
9	Q104	G-S	O											O			Pin=22W
		D-S	O									O		O			
		D-G	O							O				O			ZD101, Q106, R444, R445, D404, A403
		S		O						O				O			ZD101, Q106, R444, R445, D404, A403
		G		O						O				O			Da: Q104
		D		O												O	Q103 temp. rise 50°C --> 72°C

№	Test Position: Location №	Test Position: Test Point	Test Mode: Short	Test Mode: Open	1 Fire	2 Smoke	3 Burst	4 Smell	5 Red Hot	6 Damaged	7 Fuse opened	8 OVP	9 OCP	10 No Output	11 No Change	12 Others	Note
10	Q113	G-S	O											O			
		D-S	O							O			O	O			Q114
		D-G	O							O			O	O			Q113, Q114, D130, R188, R265
		S		O						O			O	O			Q113, Q114, D130, R188, R265
		G		O						O			O	O			Q113, Q114
		D		O										O			
11	Q114	G-S	O											O			
		D-S	O							O			O	O			Q113
		D-G	O							O			O	O			Q113, Q114, D132, R190, R266
		S		O						O			O	O			Q113, Q114, D132, R190, R266
		G		O						O			O	O			Q113, Q114
		D		O										O			
12	Q501~Q504	G-S	O							O			O	O		O	Pin up by 50W; after 7min No Output Da: Q501~Q504
		D-S	O							O			O	O			Q507~Q510
		D-G	O							O			O	O			Q501~Q504, Q505
		S		O												O	Input power was increased by 5W
		G		O												O	Input power was increased by 5W
		D		O												O	Input power was increased by 5W
13	Q507~Q510	G-S	O							O			O	O		O	Pin up by 50W; after 7min No Output Da: Q507~Q510
		D-S	O							O			O	O			Q501~Q504
		D-G	O							O			O	O			Q507~Q510, Q506
		S		O												O	Input power was increased by 5W
		G		O												O	Input power was increased by 5W
		D		O												O	Input power was increased by 5W
14	Q551, Q552	G-S	O													O	Input power was increased by 10W
		D-S	O							O			O	O			Q555, Q556
		D-G	O							O			O	O			Q551, Q552, Q555, Q556, D656, R663, A652
		S		O												O	Input power was increased by 5W
		G		O												O	Input power was increased by 5W
		D		O												O	Input power was increased by 5W
15	Q553, Q554	G-S	O													O	Input power was increased by 10W
		D-S	O							O			O	O			Q557, Q558
		D-G	O							O			O	O			Q553, Q554, Q557, Q558, D657, R657, A653
		S		O												O	Input power was increased by 5W
		G		O												O	Input power was increased by 5W
		D		O												O	Input power was increased by 5W

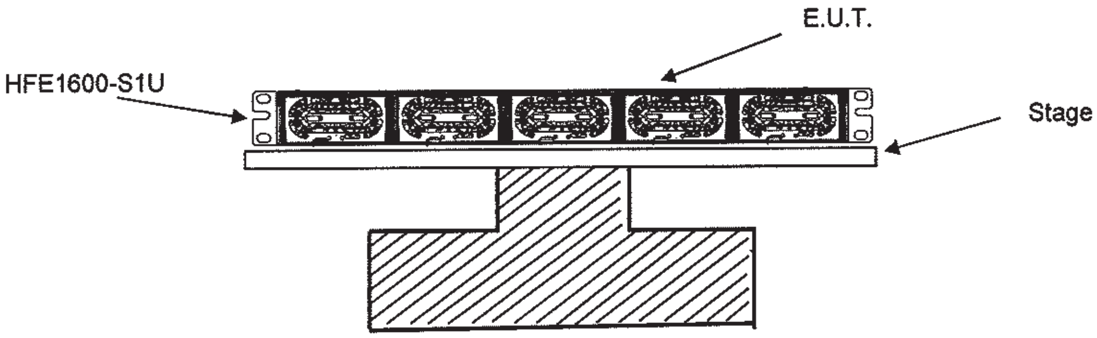
№	Test Position		Test Mode		Test Result												
					1	2	3	4	5	6	7	8	9	10	11	12	
	Location №	Test Point	Short	Open	Fire	Smoke	Burst	Smell	Red Hot	Damaged	Fuse opened	O V P	O C P	No Output	No Change	Others	Note
16	Q555, Q556	G-S	O													O	Input power was increased by 10W
		D-S	O							O			O	O			Q551, Q552
		D-G	O							O			O	O			Q551, Q552, Q555, Q556, D654, R662, A652
		S		O												O	Input power was increased by 5W
		G		O												O	Input power was increased by 5W
		D		O												O	Input power was increased by 5W
17	Q557, Q558	G-S	O													O	Input power was increased by 10W
		D-S	O							O			O	O			Q553, Q554
		D-G	O							O			O	O			Q553, Q554, Q557, Q558, D655, R656, A653
		S		O												O	Input power was increased by 5W
		G		O												O	Input power was increased by 5W
		D		O												O	Input power was increased by 5W
18	C106~C109		O								O			O			F101
				O											O		Output voltage ripple increase
19	C144~C159		O										O	O			
				O											O		
20	C160~C162		O										O	O			
				O												O	Output voltage ripple increase
21	C611~C618		O										O	O			
				O											O		
22	C619~C626		O							O			O	O			Q113, Q114, Q551, Q552, Q555, Q556
				O											O		
23	C627~C634		O							O			O	O			Q113, Q114, Q553, Q554, Q557, Q558
				O											O		
24	T101	1-2	O											O			
		3-5	O							O				O			R151, R172, R173
		6-7	O											O			
		7-8	O											O			
		9-10	O											O			
		11-12	O											O			
		3		O										O			
		1		O										O			
		6		O												O	Voutput increase to maximum
		8		O											O		
		9		O										O			
		11		O												O	Vaux=0
25	T102	1-2	O							O				O			Q651~Q654, D658~D661
		3-4	O							O				O			Q651~Q654, D658~D661
		7-8	O							O				O			Q651~Q654, D658~D661
		1		O										O			
		3		O										O			
		7		O										O			

№	Test Position		Test Mode		Test Result												
	Location №	Test Point	Short	Open	1 Fire	2 Smoke	3 Burst	4 Smell	5 Red Hot	6 Damaged	7 Fuse opened	8 OVP	9 OCP	10 No Output	11 No Change	12 Others	Note
26	T103	1-2	O												O		
		1		O											O		
27	T104	Prim	O							O				O			Q113, Q114, Q103, Q104, R103
		Sec	O							O				O			Q113, Q114, Q103, Q104, R103
		Prim		O										O			
		Sec		O										O			
28	L104		O							O	O			O			Q102
				O												O	Q101 temp. rise increase from 45°C to 95°C, D107 temp. rise increase from 50°C to 80°C
29	L105		O							O				O			Q103, Q104, R103
				O										O			

6.VIBRATION TEST

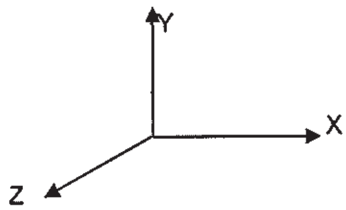
1) Vibration test class
   Frequency variable endurance test
2) Equipment used
   Controller: Dactron   Model:Laser
   Vibrator: Ling Dynamic Systems   Model:V875

3) Testing method
   HFE1600 installed in HFE1600-S1U



4)Test condition

A) Vibration Test with Frequency Sweep



Sinusoidal Vibration in Freq.: 5 - 500 Hz
Test level: 1.5G
Test time: 1 oct/min, 20 sweeps Per axis
Test performed in Axes x-y-z

B) Mech. Shock

Test level: half sine, 36G 11ms
3 mech.shocks in all of the 3 axes at each direction.

5)Test Result

Vibration:

Check item	Vout	Ripple and noise
Initial Directions	12.02V	180mV
X	12.03V	182mV
Y	12.02V	180mV
Z	12.02V	182mV

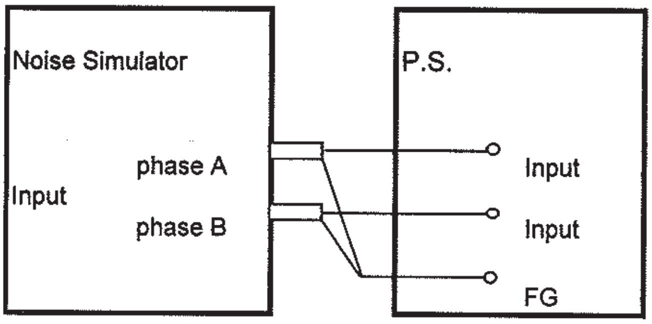
Shock:

Check item	Vout	Ripple and noise
Initial Directions	12.03V	180mV
X	12.02V	180mV
Y	12.03V	182mV
Z	12.02V	181mV

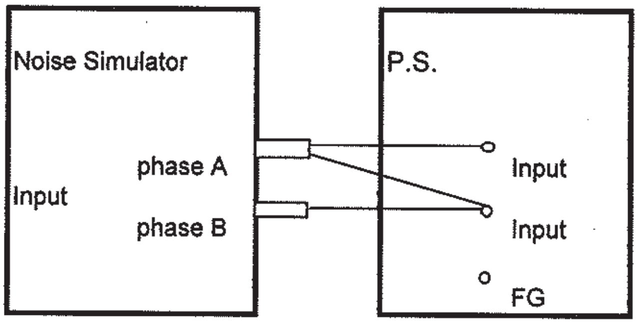
7.NOISE SIMULATION TEST

24V

1) Test circuit and Equipment



Common Mode Noise Test



Normal Mode Noise Test

Impulse noise simulator: INS-4040 (NoiseKen)
Coupling decoupling network: IJ -4050 (NoiseKEN)

2) Acceptance criteria
No damage to P.S.
No output shutdown
No other abnormalities

3)Test condition:
Input voltage:115,230Vac
Output voltage:Rated
Output current:0%,100%
Ambient temperature:25ºC
Pulse width:50ns~1000ns

Noise level:0V~2kV
Phase shift:0~360º (step 45º)
Polarity: +,-
Mode:Normal,Common
Line:Trigger select

4)Test Result : **OK**

8.THERMAL SHOCK TEST

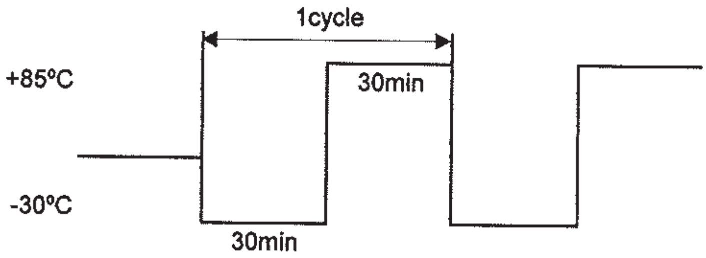
24V

1) Test Equipment

Thermal Shock Chamber: TSA-101S-W (TABAI ESPEC CORP.)

2)The number of D.U.T.(Device Under Test)
1 (unit)

3)Test condition
Ambient temperature:-30°C <=> +85°C
Test time: Refer to Dwg.
Test cycle: 200cycles
Not operating



4)Test method
Before testing,check if there is no abnormal output,then put the D.U.T. in testing chamber, and test it according to the above cycle. 200cycles later,leave it for 1hour at the room temperature,then check if there is no abnormal output.

5)Test Result **OK**

Vin:200Vac

Before testing			After testing		
Vout-100%,Iout-100%	Vout-100%,Iout-0%	P-t-P	Vout-100%,Iout-100%	Vout-100%,Iout-0%	P-t-P
24.068V	23.969V	91mV	24.046V	23.964V	92mV

9.FAN LIFE EXPECTANCY

1) Part name
109P0412K3563 (SANYO DENKI CO.)

2)Life expectancy
The data shows fan life expectancy for fan only by manufacture (90% survival rate).
Fig1. shows measuring point of fan exhaust temperature.

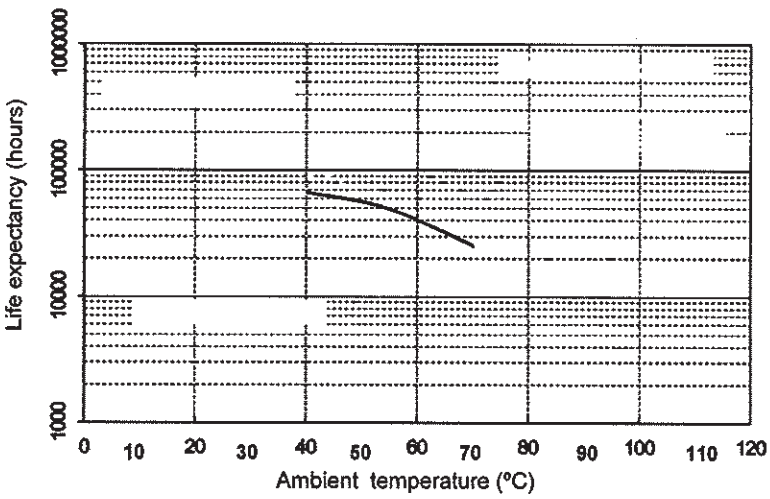


Fig1.
Measuring point of fan exhaust temperature.